DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR.

Circular / Syll. Sec./ A.C. Res./ Curriculum/ 2026.

It is hereby inform to all concerned that, on the recommendation of Board of Studies; **the Academic Council at it's Meeting held on 28th July, 2026 has accepted the *"Curriculum of Pre-Ph.D. Course Work as per Guidelines of University"*.**

This is effective from the Academic Year 2026-27 and onwards as per appended herewith.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Chhatrapati Sambhajinagar-431 004.
Ref. No. Syll. Sec./A.C. Res./
Curriculum/ 2026/ 223-24

Date: 31/ 07/ 2026.

Deputy Registrar
Syllabus Section

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Copy forwarded with necessary action to:-

1] **The Head, all concerned departments,**
2] **The Director,** University Network & Information Centre, UNIC, with **a request to upload this Circular on University Website.**
3] **The Director, Board of Examinations & Evaluation,**
4] **Public Relation Officer** [PRO],

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Dr.Babasaheb AmbedkarMarathwada University

Chhatrpati Sambhajinagar

Pre.Ph.d.course Subject wise curriculum List under the Faculty of Science & Technology.

Sr.No.	Curriculum/Subject
1.	Biochemistry
2.	Biotechnology
3.	Botany
4.	Chemistry
5.	Computer Engineering
6.	Computer Science
7.	Environmental Science
8.	Food Technology
9.	Geology
10.	Mathematics
11.	Microbiology
12.	Pharmacy
13.	Physics
14.	Statistics
15.	Zoology
16.	Civil Engineering
17.	Electronics Engineering
18.	Mechanical Engineering
19.	Nanotechnology
20.	Biophysics
21.	Pharmaceutical and Fine Chemical

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY
CHHATRAPATI SAMBHAJINAGAR – 431001, MAHARASHTRA
DEPARTMENT OF BIOCHEMISTREY

Proposed Syllabus for Centralized Pre-Ph.D. Coursework for PET-2024 Qualified Candidates

Subject: BIOCHEMISTRY

Faculty	Science and Technology
Programme	Ph.D. in Biochemistry
Course Work	Pre-Ph.D.
Medium of Instruction	English
Total Credits	12
Total Marks	200

Status: Proposed syllabus for consideration by the Board of Studies in Biochemistry and subsequent approval by the Academic Council, BAMU. It is not represented as an already-approved BAMU syllabus.

Structure of Pre-Ph.D. Course Work

Course No.	Course Name	Credits	Marks
C-1	Research Methodology	4	100
C-2(a)	Writing of Research Proposal for Obtaining Financial Assistance from National Funding Agencies	1	10
C-2(b)	Writing of Review Research Article	1	10

C-2(c)	Seminars	1	10
C-3	Subject-Specific Advanced Level Course – Biochemistry	3	50
C-4	Research and Publication Ethics	2	20
Total	Pre-Ph.D. Coursework	12	200

RESEARCH METHODOLOGY

Course Code	Category	Course Name	T	P	Total Hrs.	Credits (T+P)
Ph.D.-BIO-C1	**C1**	**Research Methodology**	**4**	**0**	**60**	**4+0=4**

Course Objectives

The course aims to:

1. Introduce the philosophy, nature and scope of scientific research.
2. Develop the ability to identify and formulate a research problem.
3. Train scholars in literature search, critical evaluation and formulation of research hypotheses.
4. Develop skills in experimental design and research planning.
5. Introduce quantitative and statistical approaches used in biochemical research.
6. Develop competency in data analysis, interpretation and scientific reporting.
7. Familiarize scholars with modern computational and bioinformatics resources relevant to Biochemistry.
8. Develop scientific writing and presentation skills.

Course Outcomes

After successful completion, the Ph.D. scholar will be able to:

CO1: Explain the fundamentals and principles of scientific research.

CO2: Identify research gaps and formulate appropriate research questions and hypotheses.

CO3: Design appropriate biochemical experiments with suitable controls and replication.

CO4: Apply statistical methods for analysis and interpretation of biochemical data.

CO5: Use scientific databases and computational tools for biochemical research.

CO6: Prepare research reports, proposals and scientific presentations.

Sr. No.	Topic	Detail of Syllabus	Hrs.
Unit I	**Fundamentals of Scientific Research**	Meaning, nature and objectives of research. Characteristics of scientific research. Scientific method and scientific reasoning. Basic, applied and translational research. Quantitative and qualitative approaches. Exploratory, descriptive and experimental research. Research process: conceptualization to reporting. Research questions and research objectives. Variables and their types. Research gap and significance of research.	8
Unit II	**Research Problem and Literature Review**	Defining the research problem. Identification of research problems. Sources of research problems. Selection of research problem. Criteria for selection of a research problem. Scope, significance and feasibility of a research problem. Concept and importance of literature survey. Primary, secondary and tertiary sources. Scientific journals, books, reviews, theses and patents. Literature-search strategies and keywords. PubMed/MEDLINE, Scopus, Web of Science, Google Scholar and NCBI. Critical evaluation of published literature. Identification of research gaps.	12
Unit III	**Hypothesis and Research Design**	Concept of hypothesis. Characteristics of a good hypothesis. Formulation of hypothesis. Types of hypothesis. Working hypothesis. Null and alternative hypotheses. Hypothesis testing. Level of significance and p-value. Type I and Type II errors. Importance of hypothesis in decision-making. Concept and principles of research design. Experimental and observational designs. Variables, controls and experimental groups. Randomization, replication and blinding. Sampling and sample-size considerations.	8

Unit IV	**Research Planning and Implementation**	Developing the research plan. Formulation of research objectives and experimental strategy. Selection of research methods and techniques. Experimental workflow and time schedule. Pilot studies. Sample collection, handling and preservation. Standardization and validation of methods Accuracy, precision, reliability and reproducibility. Quality control and quality assurance. Research documentation and laboratory records. Data recording, storage and backup. Implementation and monitoring of research plan. Troubleshooting and modification of experimental procedures.	12
Unit V	**Quantitative Methods And Data Analysis**	Nature and types of biological data. Population and sample Sampling methods and sampling errors. Classification and tabulation of data. Measures of central tendency: mean, median and mode. Measures of dispersion: range, variance and standard deviation. Standard error and coefficient of variation. Probability and normal distribution. Confidence intervals. Student's *t*-test. Chi-square test. Analysis of variance (ANOVA). Correlation and regression. Parametric and non-parametric tests. Interpretation of statistical results	8
Unit VI	**Research Interpretation and Scientific Reporting**	Computer applications in scientific research. Spreadsheet applications for research data. Data organization and statistical analysis. Graphs and scientific data visualization. Statistical software. Reference-management software. Scientific databases NCBI and BLAST. UniProt. Protein Data Bank (PDB). Basic bioinformatics applications. Interpretation of experimental findings. Relationship between findings and hypothesis. Comparison with existing literature. Identification of limitations. Scientific report writing. Structure of a research paper. Abstract, Introduction, Materials and Methods, Results and Discussion Conclusions	12

		and future directions. Referencing and citation. Oral and poster presentation of research findings	

References

1. Kothari, C.R. and Garg, G. Research Methodology: Methods and Techniques. 5th ed., New Age International Publishers, New Delhi, 2024 (ISBN 978-93-89802-55-9).
2. Creswell, J.W. and Creswell, J.D. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 6th ed., SAGE Publications, 2022.
3. Zar, J.H. Biostatistical Analysis. 5th ed., Pearson Education, 2014.
4. Wilson, K. and Walker, J. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. 8th ed., Cambridge University Press, 2018

Course Code	Category	Course Name	T	P	Total Hrs.	Credits (T+P)
Ph.D.-BIO-C3	**C3**	**Advanced Bioinstrumentation and Analytical Techniques**	**3**	**0**	**30**	**3+0=3**

Course Objectives

The course aims to:

1. Introduce fundamental biophysical, bioanalytical and separation techniques.
2. Explain the principles and applications of microscopy and spectroscopy.
3. Develop knowledge of chromatographic and electrophoretic techniques.
4. Introduce radiolabeling and radioisotope techniques in biological research.
5. Develop skills in selecting appropriate techniques for biochemical analysis.
6. Develop competency in interpretation of analytical data and evaluation of techniques.

Course Outcomes

After successful completion, the Ph.D. scholar will be able to:

CO1: Explain the principles of major bioanalytical and biophysical techniques.

CO2: Describe the instrumentation and applications of microscopy and spectroscopy.

CO3: Select appropriate chromatographic and electrophoretic techniques for biomolecule analysis.

CO4: Explain the principles and applications of radiolabeling techniques.

CO5: Interpret data generated using advanced bioanalytical techniques.

CO6: Evaluate the suitability, advantages and limitations of analytical techniques for biochemical research.

Sr. No.	Topic	Detail of Syllabus	Hrs.
Unit I	**Basics of Biophysical and Separation Techniques**	Molarity (M) and normality (N): concepts, calculations, relationship and applications in biochemical analysis. Homogenization of biological samples and extraction of proteins, nucleic acids and lipids. pH, calibration and buffers; acid–base titrations. Viscosity, factors affecting viscosity, viscometry and its significance in biological systems. Separation based on size using micro-, ultra- and nanomembrane filters; reverse osmosis and filtration in sample preparation. Dialysis and its applications in biomolecule purification. Centrifugation: principle of sedimentation, differential, analytical and density-gradient centrifugation.	4
Unit II	**Microscopy**	Overview and principles of microscopy. Basic principles and components of light microscopy. Dark-field microscopy: principle and applications. Phase-contrast microscopy: principle and applications. Fluorescence microscopy: principle and applications in cellular imaging. Confocal microscopy: principle and applications. Atomic Force Microscopy (AFM): principle and applications. Scanning Electron Microscopy (SEM): principle and applications. Transmission Electron Microscopy (TEM): principle and applications. Freeze-fracture techniques. Specific staining of biological materials.	6

Unit III	**Spectroscopy**	Overview and types of spectroscopic techniques. Electromagnetic radiation and its interaction with matter. Principles of molecular excitation. Jablonski diagram. Fluorescence and phosphorescence mechanisms. Beer–Lambert law and its limitations. UV–Visible spectroscopy: principle, theory, instrumentation and applications. Fluorescence spectroscopy: principle, instrumentation and applications. IR and Raman spectroscopy: principles and applications.X-ray diffraction: principle and applications. Mass spectroscopy: principle and applications. NMR spectroscopy: principle and applications.	6
Unit IV	**Chromatographic Techniques**	Definition, classification and principles of chromatography. Paper chromatography: principle and applications. Thin-Layer Chromatography (TLC): principle and applications. High-Performance Thin-Layer Chromatography (HPTLC). Column chromatography. Ion-exchange chromatography. Size-exclusion chromatography. Affinity chromatography. Gas Chromatography (GC). High-Performance Liquid Chromatography (HPLC). Fast Protein Liquid Chromatography (FPLC). Basic setup and operating characteristics of chromatographic techniques. Applications of chromatographic techniques in biochemical analysis and biomolecule purification.	6
Unit V	**Electrophoresis and Radiolabeling Techniques**	Definition, types and principle of electrophoresis. Basic setup and operating characteristics. Agarose gel electrophoresis. Native PAGE. SDS-PAGE. Capillary Electrophoresis (CE). Pulse-Field Gel Electrophoresis (PFGE). Isoelectric Focusing (IEF). Two-dimensional (2D) gel electrophoresis. Three-dimensional (3D) gel electrophoresis. Visualization methods. Applications of electrophoretic techniques. Introduction to radioisotopes.	6

		Types of radioisotopes. Radioactive decay. Detection and measurement of radioactivity. Geiger counters. Liquid scintillation counting. Counting efficiency. Autoradiography. Safety aspects of radioisotope handling. Use of isotopes as tracers in biological sciences. Biotechnological applications of radioisotopes.	

References

1. Boyer, R.F. Biochemistry Laboratory: Modern Theory and Techniques. 2nd ed., Prentice Hall, 2012.
2. Katoch, R. Analytical Techniques in Biochemistry and Molecular Biology. Springer, 2011.
3. Harvey, D. Modern Analytical Chemistry. McGraw-Hill.
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5. Nelson, D.L., Cox, M.M. & Hoskins, A.A. Lehninger Principles of Biochemistry. W.H. Freeman.
6. Berg, J.M., Tymoczko, J.L., Gatto, G.J. &Stryer, L. Biochemistry. W.H. Freeman.

Professor Bhaskar Sathe,
Dean,
Faculty of Science & Technology,
Dr. Babasaheb Ambedkar
Marathwada University,
Chhatrapati Sambhajinagar

Professor & Head
Department of Biochemistry
Dr. Babasaheb Ambedkar
Marathwada University,
Chhatrapati Sambhajinagar